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Department of Entomology

THE CONTROL OF APPLE INSECTS IN CLINTON COUNTY

By C. R. CROSBY and A. J. MIX

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THE CONTROL OF APPLE INSECTS IN CLINTON COUNTY

C. R. Crosby and A. J. Mix

It is the purpose of the writers to discuss in this bulletin the insects that cause greatest injury to apples in Clinton County. Four years ago, when the writers first took up the study of the insect problems of that section, they were immediately convinced that owing to location and climate it would be necessary to modify the system of spraying usually employed in western New York, to fit local conditions. Although this bulletin is primarily intended to give practical directions for the control of orchard insects, nevertheless it is considered advisable to state the fundamental facts in the life history of each insect in order that there may be an intelligent understanding of the reasons for each operation. Conditions vary so greatly from season to season that it is impossible to devise any set of spraying rules to be followed blindly; the grower should become familiar with the insect enemies of his orchard, so that he may adapt his spraying operations to the peculiar needs of the season. The junior author has spent the last two seasons in Clinton County, studying the problems that confront the fruit grower in the control of insect pests and plant diseases. This work was made possible by the establishment of an industrial fellowship in the New York State College of Agriculture by the Champlain Valley Fruit Growers' Association.

CODLING MOTH (*Carpocapsa pomonella* Linnæus)

The codling-moth caterpillar is the insect that causes the great proportion of wormy apples, and it is the most serious insect pest with which fruit growers in northern New York have to contend. In unsprayed orchards it causes a loss of twenty-five to fifty per cent of the crop. According to the census of 1910, there were 24,564 barrels of apples raised in Clinton County. Assuming that one-fourth of the crop was destroyed by the codling moth, the production that year should have been 32,752 barrels; thus the loss was 8188 barrels. Estimating the value of these apples at one dollar a barrel, the loss would be $8188. According to the same census there were 147,313 bearing trees in Clinton County. It is estimated that twenty per cent of these trees are sprayed at least once for the codling moth. The cost of this work is not far from ten cents a tree, or $2946.20. The sum of the loss of the fruit and the cost of spraying necessitated by the codling moth is $11,134, which represents the annual tax levied on Clinton County by this insect.

The codling moth passes the winter as a full-grown caterpillar in a slight silken cocoon, under flakes of bark and in crevices on the trunk and the larger branches of trees. With the advent of warm weather in the spring, the caterpillar transforms inside its cocoon to a brownish pupa about one-half inch in length (Fig. 36). In a little less than a month the mature insect, or moth, emerges. The moth (Fig. 37) has an expanse of about three-fourths of an inch. The front wings have the general appearance of watered silk, and are marked near the tip with a light brown spot bounded on the inside by a chocolate band. The moths are rarely seen in the orchard, for their dull colors harmonize perfectly with the gray bark of the branches on which they rest during the daytime. They fly mostly in the dusk of the evening.

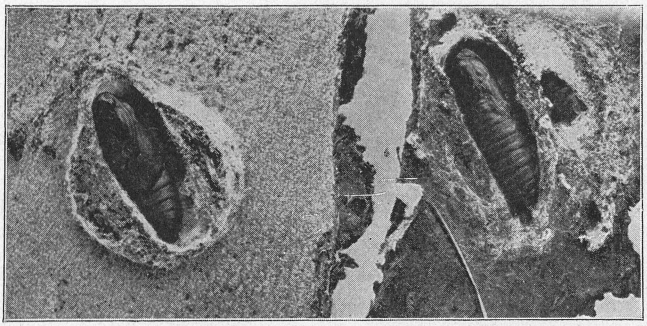


FIG. 36.— *Pupæ of codling moth, in their cocoons. Enlarged*

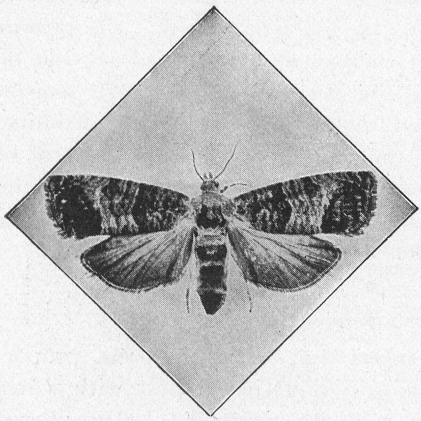


FIG. 37.— *Codling moth, enlarged*

The moths continue to emerge during a period of several weeks, but the greatest number appear about two weeks after the petals fall. If the weather is warm the moths begin to lay eggs in four or five days; but if the weather is cool or stormy, egg laying may be deferred for a considerable period. The female moth deposits her flat, disk-shaped, scale-like eggs, about one-twenty-fifth inch in diameter, on the leaves and skin of the fruit, not in the blossom end of the apple (Fig. 38). As the moths emerge during a considerable period, egg laying also continues for several weeks, but the greater part of the eggs are laid

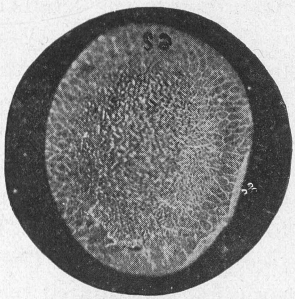


FIG. 38.— *Codling-moth egg, greatly enlarged*

about three weeks after the petals fall. The eggs hatch in a week or ten days. On hatching, the young caterpillar, which is about one-sixteenth inch in length, may feed slightly on the foliage before reaching the fruit.

Most of the caterpillars enter the fruit at the blossom end. A few enter at the stem end or at the side, where two fruits touch. Most of them enter the fruit about three weeks after the petals fall. The caterpillar burrows directly to the core, devours the seeds, and, when nearly full-grown, tunnels out to the surface, usually at the side of the apple, leaving its burrow practically filled with a mass of excrement (Fig. 39). The time spent by the caterpillar in the apple averages about one month.

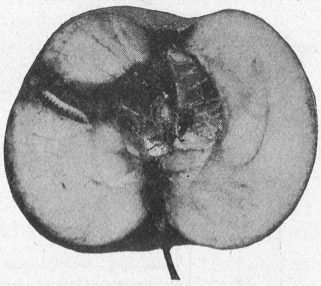


FIG. 39.— *Full-grown codling-moth caterpillar in its burrow in an apple*

When full-grown, the caterpillar leaves the apple, crawls to the trunk or the larger branches, and there in some protected crevice forms a silken cocoon. Observations of the last two years in Clinton County indicate

FIG. 40.— *Two apples in perfect condition for spraying. The petals have just fallen. Note that the calyx lobes are widely spread*

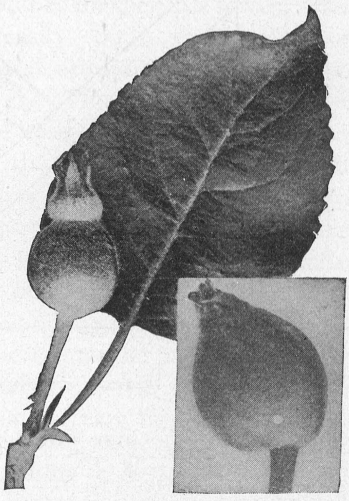


FIG. 41.—*Too late to spray effectively. Note that the calyx lobes are nearly together.*
Egg of codling moth on young apple

that as a rule these caterpillars do not transform to moths until the following spring, and that the second brood of caterpillars is therefore unim-

portant in that region. In western New York, however, some of the caterpillars spinning cocoons before the first of August may transform in the same season, thus producing a second brood of moths.

Means of control

The most important spray for the control of the codling moth should be applied just as the last of the petals are falling. This spray consists of 6 pounds of arsenate of lead, $2\frac{1}{2}$ gallons of lime-sulfur, and water to make

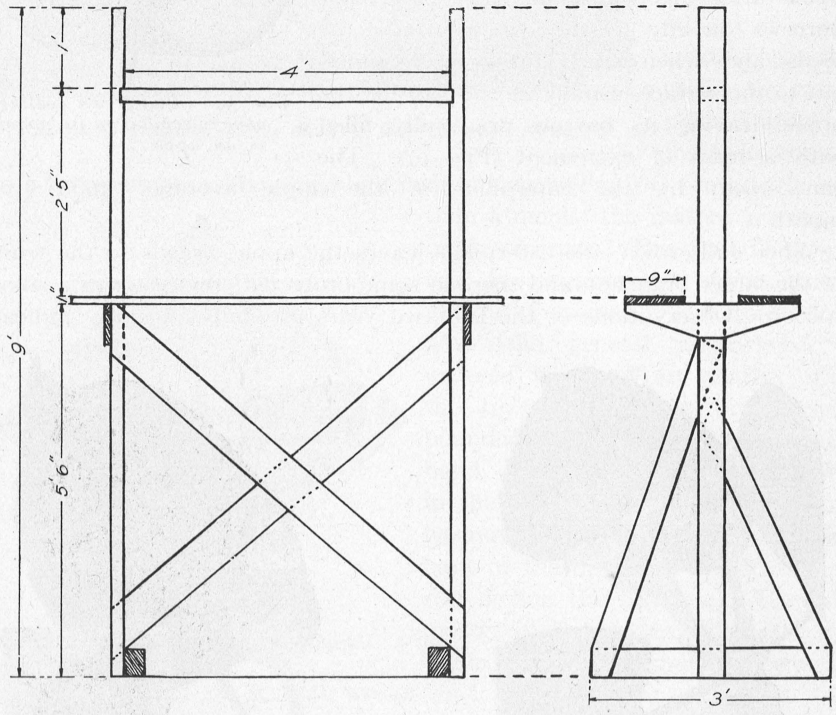


FIG. 42.— *Working drawing of a cheap but serviceable spraying tower*

100 gallons. The lime-sulfur has no effect on the codling moth, but is used for the control of apple scab. At this time the calyx lobes at the blossom end of the apple are expanded (Fig. 40), and it is possible to drive the poison down into the calyx cavity. In a few days the calyx lobes close over this cavity and this prevents the washing away of the poison by rain (Fig. 41). The majority of the young caterpillars enter the fruit by the blossom end, and will be poisoned in the calyx cavity before they can injure the fruit.

In order to be effective it is important that the spray be directed down-

ward into the ends of the young apples, and that sufficient force be used to drive it into the calyx cavity. Good results cannot be obtained by spraying from the ground, or, in the case of large trees, by a man standing in a wagon box. A tower should be used, high enough so that by the use of an extension rod and an angle nozzle it will be possible to reach out over the tree and direct the spray downward into the ends of the young fruits. Spraying upward into a tree and letting the spray fall down into the top is a waste of time and material as far as control of codling moth is concerned. Spraying so that a cluster is hit on the side instead of at the end is ineffectual, since the force of the spray pushes the cluster over and no material enters the calyx cavity. The young apples that hang so that they are hit squarely in the end by a sidewise spray are the ones that fall later; it is the center apples of a cluster that develop to maturity.

FIG. 43.— *An angle nozzle attached to a bamboo extension rod*

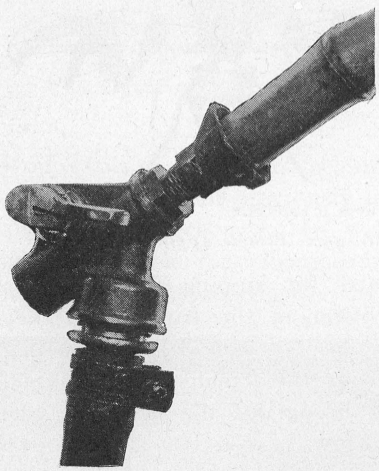


FIG. 44.— *An angle double-ball shut-off attached to the base of an extension rod and connected with a hose leading to the pump. This type of shut-off will not leak, and is very easily turned on and off. The hose is attached at an angle, and therefore does not kink nor break; also, the rod is easy to hold*

A satisfactory inexpensive tower, which can be easily built from materials usually found around the farm, is shown in Figure 42. The front and rear posts and saddle rails are made of 2x4-inch material; the footboards should be 1x9-inch oak boards; the supports for the footboards and the side and end braces may be inch boards of any description. The bottom crosspieces are preferably made of 3x4-inch material, but 2x4-inch pieces may be used if necessary. The dimensions of the tower are given in the accompanying figure and may be varied to meet individual requirements. Such a tower can be chained into a wagon box or fastened to the top of the spray tank and removed when not in use. It is easy to ride; the rail is gripped by the operator's knees, leaving the hands free for spraying. Wherever it has been used it has given entire satisfaction.

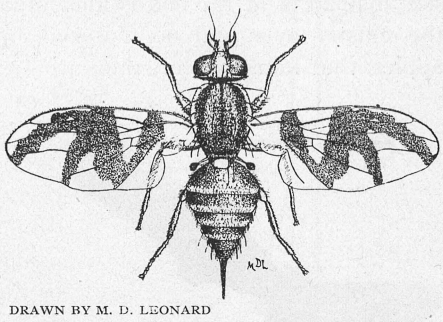
The best type of angle nozzle to use is one in which the bend is in the nozzle itself. not in the pipe back of the nozzle (Fig 43); in such an arrange-

ment as the latter, the pipe catches on the branches and this interferes with rapid work. The nozzle should be attached to the end of a 10-foot bamboo extension rod, which is provided with a shut-off. A very convenient type of shut-off is the angle double-ball shut-off shown in Figure 44. This may be closed or opened by merely pressing with the thumb, and does not leak when closed — a common fault of most shut-offs.

The second application is made three weeks after the petals have fallen, because at that time the codling-moth caterpillars are beginning to hatch and to enter the fruit.

APPLE MAGGOT (*Rhagoletis pomonella* Walsh)

In Clinton County the apple maggot is frequently known as the railroad worm. It is especially destructive to Tolman, Fameuse, and McIntosh apples. The small white maggots tunnel through the flesh of the fruits, rendering them unfit for food, and often cause the growers serious financial loss.



DRAWN BY M. D. LEONARD

FIG. 45.— *Female apple maggot fly*

The parent flies are slightly smaller than the house fly and have the wings crossed by three dark bands (Fig. 45). The flies appear in the latter part of June or the first of July, and may be seen resting on the fruit and foliage. Their mouth parts are adapted for lapping fluids. They feed on drops of moisture and on the bloom of the fruit, which they first dissolve with a drop of saliva. After feeding for two or three weeks the female begins laying, which is continued throughout the summer. She inserts her minute white eggs in the flesh of the apple through a puncture in the skin (Fig. 46). The eggs hatch in from two to six days and the larvæ burrow through the flesh of the fruit (Fig. 47). If the flesh is hard the maggots grow very slowly and are difficult to find before the fruit begins to ripen or to soften from decay.

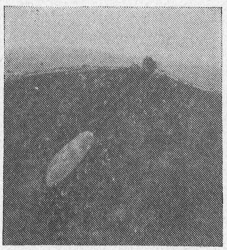


FIG. 46.—*Egg of apple maggot inserted in the flesh of an apple just beneath the skin. Greatly enlarged*

When full-grown the maggot (Fig. 48) emerges from the fruit through a ragged hole in the skin, burrows into the ground an inch or so, and there within the thickened and hardened skin, known as the puparium (Fig. 49), transforms to a delicate whitish pupa, in which condition the insect remains until the following spring.

Means of control

In orchards that have been seriously infested in previous years, two or three applications of sweetened arsenate of lead should be made

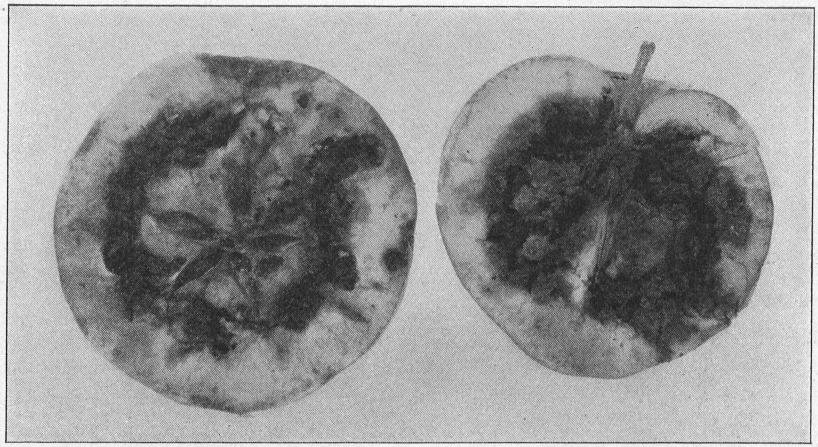


FIG. 47.— *Apples infested by apple maggots, cut open in order to show decaying interior*

at intervals of two weeks, beginning about the first of July. In orchards that have not been previously infested, special applications of sweetened spray are unnecessary. In well-cultivated orchards, where conditions are unfavorable for hibernation of the puparia, the pest is ordinarily held in check by the regular system of spraying in use for the control of

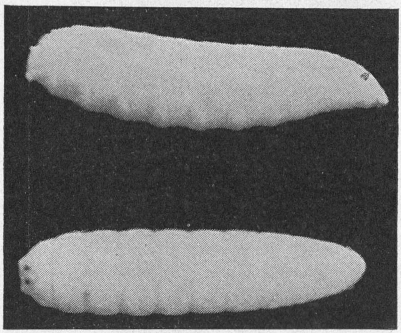


FIG. 48.— *Lateral and dorsal view of full-grown apple maggots*

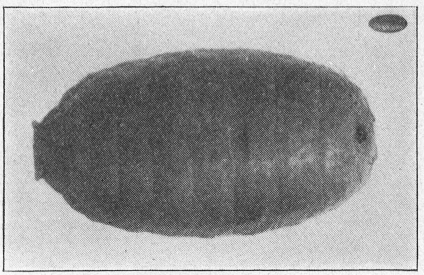


FIG. 49.— *Puparium of apple maggot, enlarged. Natural size shown in upper right corner*

the codling moth, the last application being made three weeks after the petals fall. The sweetened spray is much less adhesive than the unsweetened

spray, and when it is used it is necessary to repeat the application after each rain. The formula most commonly used for the sweetened spray is:

Arsenate of lead	6 pounds
Molasses	2 gallons
Water	100 gallons

In applying the sweetened mixture it is not necessary to spray with the same care as in applying the other sprays, because in this case the material is used as a bait. The flies are attracted to it from other parts of the tree.

GREEN FRUIT-WORMS (*Xylina antennata* Walker, and other species)

Green fruit-worms are large, greenish, light-striped caterpillars, one to one and one-half inches in length, and in some years are very destructive to apples and other fruits. Outbreaks occur at intervals of several years, during which the pest is almost unknown. The pest has been especially destructive in Clinton County during 1913 and 1914.

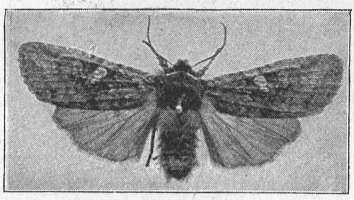


FIG. 50.— *Moth of green fruit-worm*

The mottled gray moths (Fig. 50) appear in the orchard early in the spring, in March or April, and deposit their eggs singly on the branches of the trees. The eggs hatch just as the buds are opening; the young caterpillars feed on the opening leaves and become about half-grown when the fruit sets. They do not burrow into the fruit, but eat out large cavities, sometimes devouring nearly the whole apple (Fig. 51). When the fruit is not too badly injured, the wound heals over, leaving a large, rough, corky scar. The caterpillars become full-grown about the middle of June. They descend to the ground, and a few inches below the surface transform to brownish pupæ in earthen cells which are usually lined with a slight silken cocoon. Most of the moths emerge in September and hibernate in sheltered places, but a few do not emerge until the following spring.

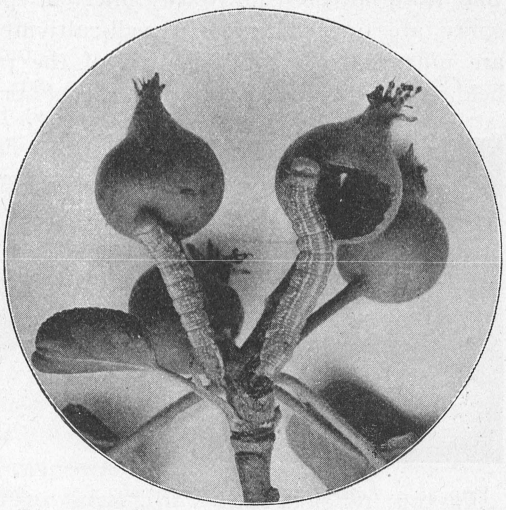


FIG. 51.— *Green fruit-worms feeding on young apples*

Means of control

By the time the caterpillars attack the young fruits they are nearly full-grown, and it is then too late to kill them with poison sprays. Caterpillars of this size are very resistant to poisons, and furthermore the greater part of their food consists of the flesh of the fruit, which it is impossible to poison. Effective work can be done, however, by very thorough applications of arsenate of lead, 6 to 8 pounds to 100 gallons of spray solution, made just before the blossom cluster separates. Success in fighting green fruit-worms cannot be expected unless the work is done with great thoroughness.

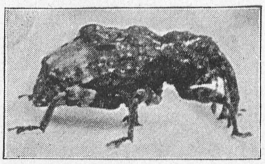
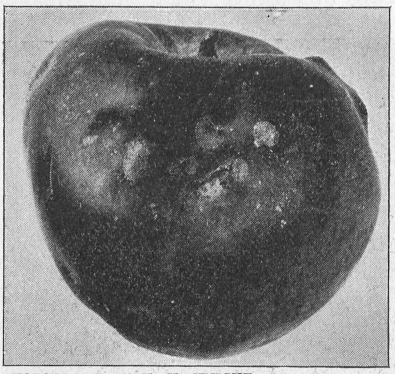


FIG. 52.— *Beetle of plum curculio. Enlarged*



PHOTOGRAPH BY H. H. KNIGHT

FIG. 53.— *Apple scarred by egg-laying punctures of the plum curculio*

PLUM CURCULIO (*Conotrachelus nenuphar* Herbst)

In some orchards the fruit is likely to be badly scarred by the feeding and egg-laying punctures of the plum curculio (Figs. 52 and 53). This injury is always severest in neglected orchards. The curculios hibernate in hedges, stone walls, and stone piles, and the first step in their control is the elimination of such shelters. A rank growth of grass or weeds in an orchard also tends to increase injury from curculio. Well-cultivated orchards are less subject to attack. Curculio injury is also greater in trees with bushy, unpruned tops.

Under favorable conditions, where the trees are properly pruned and the orchards are well cultivated, and where stone walls, stone piles, and hedgerows are not allowed in the vicinity of the orchard, the plum curculio can be controlled by the regular system of spraying employed for the control of the codling moth.

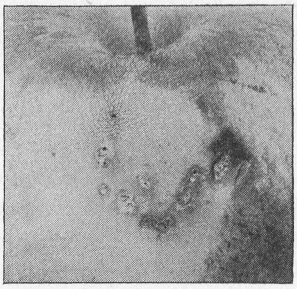


FIG. 54.— *Apple injured by a bud-moth caterpillar in late summer*

BUD MOTH (*Tmetocera ocellana* Schiffermüller)

The bud moth is a common and troublesome pest in Clinton County orchards. The small, brown, black-headed, half-grown caterpillars hibernate in obscure bark-colored cocoons hidden

away in the angles of the apple twigs. The caterpillars leave their winter quarters just as the buds are bursting, burrow into the opening buds, and feed on the expanding leaves. They often web two or three leaves together, and often include several blossoms in the nest thus formed. They may therefore nip in the bud a considerable part of the future crop. When full-grown the caterpillars pupate in this nest of webbed leaves, and the moths emerge during June and the first part of July and deposit their eggs in small clusters on the leaves. The eggs hatch in a week or ten days, and the young caterpillars feed on the underside of the leaves in a small silken tube open at both ends. When a leaf touches an apple the caterpillars often make a number of small holes in the surface of the fruit, thus causing blemishes which may greatly

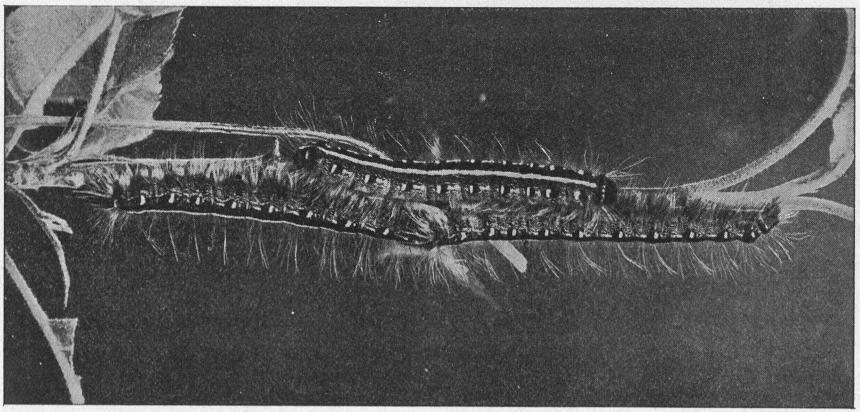


FIG. 55.— *Full-grown apple tent-caterpillars*

decrease the value of the crop (Fig. 54). The caterpillars become about half-grown by the end of the season, and go into winter quarters in little cocoons on the branches.

Means of control

Experiments have shown that it is not practicable to destroy the caterpillars in their winter quarters by dormant sprays. Effective work against this insect can be done, however, by thorough application of arsenate of lead, 6 pounds to 100 gallons of water or dilute lime-sulfur, when the blossoms show pink. This coincides with the first application for the control of apple scab. This one spraying, alone, will not kill all the caterpillars, but if made in conjunction with the regular system of spraying for the codling moth, and continued over a period of several years, it will so reduce their number as to render them a negligible factor in the orchard.

APPLE-TREE TENT-CATERPILLAR (*Malacosoma americana* Fabricius)

During the past two years the orchards in Clinton County have been devastated by tent caterpillars belonging to this and the following species. The apple-tree tent-caterpillars can be distinguished from the forest tent-caterpillars by the continuous light stripe down the back, instead of a row of wedge-shaped spots (Fig. 55).

The apple-tree tent-caterpillar feeds on apple, wild cherry, witch-hazel, beech, birch, barberry, oak, willow, and poplar, but it breeds most abundantly on wild cherry. The winter is passed in the egg stage. The eggs are deposited in masses of three to four hundred, usually encircling a twig as a broad band (Fig. 56). Each mass is protected by a brownish, gluey froth. The eggs hatch in the spring, just as the buds begin to show green. The caterpillars from each egg mass live in colonies, forming large, unsightly silken nests on the branches. In some cases caterpillars from two or more egg masses unite to form a single nest. When the caterpillars are abundant they often defoliate the trees, and thus not only destroy the crop of the season but so weaken the tree that it is unable to set fruit buds for the following year.

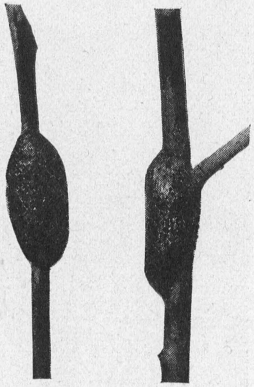


FIG. 56.— *Egg masses of apple tent-caterpillar*

The caterpillars become full-grown about the first of June and spin white silken cocoons under any convenient shelter. The moths emerge in about three weeks and lay their eggs in July. There is only one generation a year.

Means of control

Care should be taken, when trimming the orchard, to cut out and burn all twigs bearing egg masses. If these are thrown on the ground, as is often done, the eggs will later hatch and the caterpillars may find their way to the trees. On small trees it is practicable to rub out the nests with the hands, using an old pair of gloves, when the nests are very small. Burning out the nests with a torch, another common practice, is injurious to the tree; the common apple-tree cankers often develop in spots scorched by the torch. In commercial orchards the caterpillars may be satisfactorily controlled by early spraying. In the past two years in Clinton County, it has been found that the dormant lime-sulfur spray as applied for oyster-shell scale, if made when the bud tips show green, will kill nearly all the young caterpillars. When this spraying is omitted, the

second spraying, with arsenate of lead, made just as the blossoms show pink, is very effective. Later sprayings are ineffective, since it is very difficult to poison the caterpillars when they are large.

FOREST TENT-CATERPILLAR (*Malacosoma disstria* Hübner)

For the last two years the forest tent-caterpillar (Fig. 57) has been abundant throughout Clinton County, more especially so from Plattsburg northward. Many neglected orchards are in a dying condition from the attacks of this insect. The forest tent-caterpillar is naturally a forest insect, its favorite food plant being the maple; but it attacks also apple, plum, cherry, and pear. Its life history is very similar to that of the apple-tree tent-caterpillar, but the caterpillars do not form silken nests, and most of the cocoons are found in curled leaves on the trees.

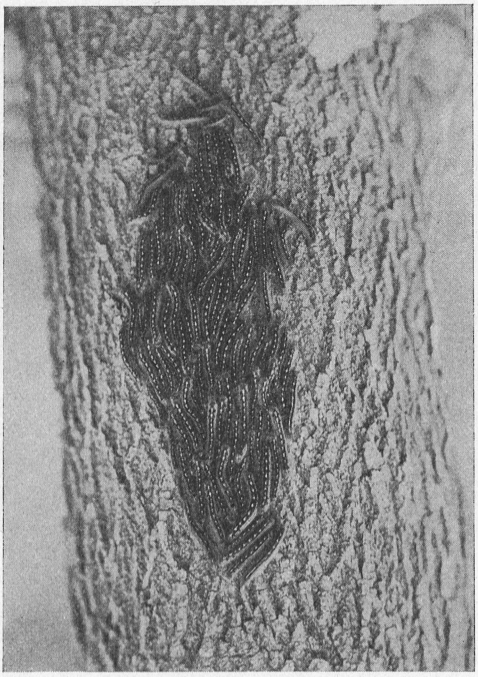


FIG. 57.— *A colony of forest tent-caterpillars resting on a tree trunk*

This insect may be controlled on apple trees by the means suggested for the apple-tree tent-caterpillar, with the obvious exception of wiping out the nests.

OYSTER-SHELL SCALE (*Lepidosaphes ulmi* Linnæus)

The oyster-shell scale is the only important scale insect found in the orchards of Clinton County. It is most injurious to young trees, stunting, and in extreme cases killing, them; old trees suffer less, but are often badly infested.

The insect passes the winter in the egg stage. From thirty to one hundred minute white eggs may be found under each old scale from September until the last of May. The eggs hatch about the last of May or the first of June. The minute, pale yellowish, young insect crawls about over the bark for a few hours and then settles down, inserts its needle-like sucking tube into the bark, and feeds on the sap. The scale-like covering is soon formed and the insect remains in one place for the remainder of its life (Fig. 58). Eggs are laid under the scale in August and September, and the

insect soon dies. Only the eggs are alive during the winter months. There is only one generation a year in this region.

Means of control

The oyster-shell scale may be controlled by thorough spraying with lime-sulfur, 1 part to 8 parts of water, the application being made when the buds begin to show the green tips of the leaves. The application should be repeated every year until the scale ceases to be injurious. Summer applications of lime-sulfur as applied for apple scab are thought to have a tendency to prevent the setting of the young scale.

FIG. 58.— *Oyster-shell scale. Section of a severely infested branch*

PLANT LICE

There are three species of plant lice injurious to the leaves and fruit of the apple in Clinton County. All these forms hibernate as small, oval, black, shiny eggs on the branches of the trees.

Grain aphis, or apple bud-aphis (*Siphocoryne avenæ* Fabricius).—The grain aphids are small, greenish lice, which often appear in countless numbers on the opening buds, but rarely cause any serious injury to apple trees owing to the fact that only one generation is spent on the apple. Most of the second generation develop wings and fly to grains and grasses, where they breed through the remainder of the season. The grain aphis is distinguished from other plant lice infesting the apple by three stripes of darker green running lengthwise of the body.

Apple leaf-aphis, or green aphis (*Aphis pomi* DeGeer).— The apple leaf-aphis usually appears on the trees at the same time as does the grain aphis discussed above; it continues to breed on the apple throughout the summer, however, and is therefore capable of causing much greater injury. It causes the leaves to curl, stunts the growth of the tree, dwarfs the apples, and prevents the normal June drop, thus producing what is known as clustering. Apples injured by aphis attack are small and deformed, and show a characteristic puckering of the blossom end (Fig. 59). This plant louse is also very destructive to young trees, which are sometimes killed outright. The apple leaf-aphis is often aided in its destructive work by the rosy aphis.

Rosy apple aphis (*Aphis sorbi* Kaltenbach).— The rosy apple aphis is often found on apple trees in company with the apple leaf-aphis. These plant lice are thinly covered with a whitish waxy bloom, and the winged

forms are of a pinkish or rosy color; hence the name rosy aphis. They appear on the buds at about the same time as does the apple leaf-aphis, but as a rule only three generations develop on the apple. After the third generation the remainder of the season is spent on broad-leaved and narrow-leaved plantain. Although the lice remain on the apple for only about two months, they are capable of doing great damage. They curl the leaves more severely than does the apple leaf-aphis, and are equally destructive to the fruit.

Means of control.— Plant lice can be fought most effectively by thorough spraying with "black leaf 40" tobacco extract, $\frac{3}{4}$ pint in 100 gallons of water or dilute lime-sulfur solution, the application being made when the lice are clustered on the opening buds. As the spray kills only by contact, very thorough work is necessary and care should be taken to hit all the plant lice with the spray. After the aphids have curled the leaves it is very difficult to hit them, and it is very doubtful whether spraying at that time is worth the trouble involved. In the case of small trees it is better to dip the infested branches in the solution wherever this can be done without breaking the trees.

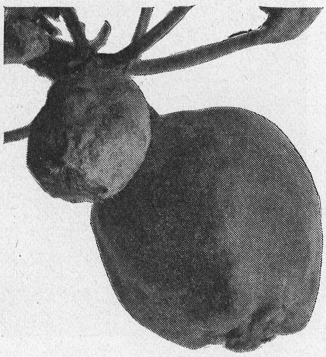


FIG. 59.— *Apples stunted and deformed as the result of aphis injury*

WOOLLY APHIS (*Schizoneura lanigera* Hausmann)

Woolly aphids are small, reddish brown, plant lice which are found in colonies on the trunks and branches, and also on the roots, of apple trees. As the lice are covered by a woolly mass of long, white, waxy fibers, these colonies are very conspicuous. In Clinton County these lice are most injurious when found in cankers and wounds, where they feed in colonies on the callus and prevent proper healing. Such wounds should be carefully cleaned out and painted with gas tar.

GRASSHOPPERS (*Melanoplus femur-rubrum* DeGeer)

During the past two seasons grasshoppers have been very destructive to a few young orchards located on the light sandy soils of Clinton County. In extreme cases they have completely defoliated the trees, and even girdled the trunk and branches.

Means of control

Grasshoppers may be controlled by the use of poison bait. The formula used by Professor G. A. Dean, of Kansas, is as follows:

Bran	20 pounds
Paris green	1 pound
Sirup	2 quarts
Oranges or lemons	3 fruits
Water	3½ gallons

The bran and the paris green, dry, are mixed thoroughly in a washtub. The juice of the oranges or lemons is squeezed into the water; the remaining pulp and peel is chopped into fine bits and added to the water. The sirup is dissolved in the water and the bran and poison are wet with the mixture, being stirred at the same time so as to dampen the mash thoroughly.

This bait should be spread over five acres of the infested area. It should be sown broadcast very thinly, in order to make it impossible for birds, fowls, and domestic animals to obtain enough poison to kill them. Very little of the bait is eaten after it becomes dry; hence it is important to scatter it in the early morning, just as the grasshoppers are becoming active. A very small quantity of the poison, if eaten, is sufficient to kill the grasshoppers.

SPRAYING SCHEDULE FOR APPLES

Dormant spray, *as the leaf buds begin to show green*

Lime-sulfur (32° Baumé) diluted 1 to 8, for oyster-shell scale and blister mite. To control plant lice, add ¾ pint "black leaf 40" tobacco extract to each 100 gallons. Make the application when the lice are clustered on the opening buds.

Summer sprays

A. As the blossom buds begin to show pink

Lime-sulfur (32° Baumé) diluted 1 to 40, for apple scab; add arsenate of lead, 6 pounds to 100 gallons, for bud moth and green fruit-worm.

B. As the last of the petals are falling

Lime-sulfur (32° Baumé) diluted 1 to 40, for apple scab; add arsenate of lead, 6 pounds to 100 gallons, for codling moth.

This is the most important spray for the control of the codling moth, and the work should be done thoroughly.

C. Three weeks after the petals fall

Lime-sulfur (32° Baumé) diluted 1 to 40, for apple scab; add arsenate of lead, 6 pounds to 100 gallons, for codling moth.

D. Last week in July

Lime-sulfur (32° Baumé) diluted 1 to 40, for apple scab.

Spray for apple maggot, first week in July

Arsenate of lead, 6 pounds to 100 gallons of water and 2 gallons of molasses. Repeat every two weeks or after each rain, until the middle of August.

Spray for plant lice, when the lice are clustered on the opening buds

" Black leaf 40 " tobacco extract, $\frac{3}{4}$ pint to 100 gallons of water or dilute lime-sulfur; if used in water add five pounds of soap to each 100 gallons.

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